RIVERS AND FLOODS, MARCH, 1913.

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THE PRECIPITATION AND FLOODS IN THE OHIO BASIN, MARCH 23 TO 27, 1913.

Excessive rains due to convectional currents.—The amount of moisture in the atmosphere, say up to 30,000 feet above sea level, can be roughly computed if the dew point is approximately known; all such computations, however, are made on the assumption that the air is saturated and that all of the moisture is precipitated, conditions known not to be fulfilled in nature; therefore the computed amounts must always be in excess of the true amounts. If we take the Ohio Valley, for example, and compute the total amount of aqueous vapor in the overlying air up to 30,000 feet and express it as the depth of water it would be equal to if all of it be precipitated as rain, we would probably be surprised to find that even under the most favorable assumptions it would barely equal an inch of water. When it is considered that occasionally ten times as much rain falls as computation shows is available, the question naturally arises: Whence comes the moisture to produce the torrential rains which occasionally occur? The conclusion is inevitable that air from the regions immediately surrounding the atmospheric disturbance must be continually drawn in and carried aloft in the general movement of air about the storm center. Convectional currents, therefore, must be intimately associated with unusually heavy and continuous precipitation, otherwise the rainfall would cease when the major portion of the moisture normally in the undisturbed air over a place has been precipitated. The air thus drawn in on the southeast quadrant of storms which occupy the great interior valleys, coming, as it does from lower latitudes, is at a higher temperature and possesses greater moisture content than does air which is drawn in toward the storm center in the northern and western quadrants; hence it would seem that the wind circulation about a storm center thus described has an important bearing on the explanation of the observed fact that thunderstorms, tornadoes, and excessive rains occur most frequently in the southeastern quadrant of the general disturbances which pass from west to east or from southwest to northeast over the United States.

Tornadoes also closely associated with convectional currents.—Ferrell was probably the first to associate tornadoes with convectional currents. His theory of tornadoes is based essentially on the occurrence of an ascensional movement, of which there is now ample evidence, in a tornado whirl. It has been clearly established that both tornadoes and thunderstorms mainly occur within the southeast quadrant of a larger general disturbance, technically known as a cyclone, or area of low pressure, the latter being expressed on the daily weather map by the single word "Low," and this word will be used in this paper to mean the general disturbances which are continually passing across the country. The vertical instability necessary to produce tornadoes is not developed in every Low, but there is sufficient vertical instability in almost every Low to produce general rains, and these may or may not be intense; some Lows yield only moderate precipitation over a limited area, but there may be several "islands," so to speak, of intense rainfall within the larger area of moderate rainfall, while in still other Lows the area of excessive rainfall may be continuous and of considerable geographic extent. As a rule, surface indications as plotted on the daily weather map do not afford any clear indication of whether the rainfall will be heavy or light, yet constant association with the weather maps leads to skill in interpreting conditions which produce rain; consequently it has been recognized that certain conditions which occur in winter and spring are quite apt to produce heavy rains in the Mississippi and Ohio Valleys. The occurrence of a single period of heavy rain at a time when the rivers are not in flood is not a serious matter, but when heavy rains recur at very short intervals the situation along the great rivers soon becomes serious.

In these preliminary remarks it has been our endeavor to point out the apparent common dependence of tornadoes and excessive rains upon atmospheric instability, the greater degree of instability occasionally producing tornadoes, the lesser excessive rains. The fact that the Low of March 23 caused tornadoes in one portion of its course and torrential rains in another is merely an indication that the physical conditions which determine atmospheric instability were highly developed on that date.

Among conditions which produce atmospheric instability are high temperatures and humidity and considerable contrasts in temperature. These also produce excessive rains as well as tornadoes. It is to be noted in passing that in the storm of March 23 the region of excessive rains was not coextensive with the center of lowest pressure, nor in the region of greatest contrasts in temperature, but that it began about 300 miles east of the center of low pressure and extended thence 500 miles farther eastward, viz, to central Ohio. From this it may be inferred that the region of atmospheric instability on the date in question covered a vast area, the outskirts of which on the eastern side produced excessive rains, the inner central areas violent windstorms.

Meteorological conditions previous to March 23.—There was nothing in the meteorological conditions charted on the daily weather maps previous to the downpour of rain that caused the disastrous floods that gave any indication of the tremendous quantity of rain which fell on subsequent dates. The Low on Sunday night, March 23, 1913, overlaid southeastern Nebraska. On that day there were heavy rains from central Illinois to western Ohio, over a strip of country probably 200 miles wide and 500 miles long, the locus of the heavy rains being in northeastern Indiana and northwestern Ohio.

Sunday night, March 23, rain continued uninterruptedly over the above territory, but the intensity was not so great. During the daylight hours of Monday, March 24, rain ceased in northern Illinois, but the intensity over southern Indiana and southern Ohio was greater than on the previous date, and it is to be noted that whereas the rainfall of the previous 24 hours had been most intense on the headwaters of the Wabash River of Indiana and of the rivers of Ohio which flow southward the area of greatest intensity on the 24th was over the lower reaches of the same streams, including both forks of the White River of Indiana.

Monday night, March 24–25, brought a continuation of the rain over Illinois, Indiana, and Ohio, and it also extended along the lower Lakes down the St. Lawrence Valley, and into northern New England. The region of great intensity, as in the previous 24 hours, being in central Indiana and over practically the whole of central and northern Ohio. During the daylight hours of Tuesday, March 25, the rainfall in Illinois was light, but it continued with little abatement over southern Indiana and central Ohio, and it was to the rainfall of this period, daylight hours of Tuesday, March 25, over Ohio and Indiana, that the rivers of those States received the increment of water which sent them forth on their impetuous career of destruction. Up to this time practically all of the precipitation had been north of the Ohio River; meantime the Low, to which the precipitation was due, had passed rapidly northeastward beyond the field of observations.

Development of secondary Low.—It sometimes happens, when a Low centered over the middle or northern portions of the United States moves rapidly northeastward, as did that of March 23, 1913, it leaves behind it a trail, so to speak, of low pressure and unsettled weather, or in the more technical language of the weather map, a trough of low pressure is formed, i. e., a region of low pressure whose bounding isobars have the form of a trough or very elongated ellipse; frequently too, the center of activity in such pressure formations may be at either or both ends of the trough. In case the northern center of activity moves rapidly to the northeast, the southern center, if only moderately well developed, generally increases in intensity and moves northeastward much as an independent Low and thus a region deluged by the upper end of the trough receives a second downpour almost immediately, due to the southern extension of one and the same storm, and this is what happened over the Ohio Valley between the dates of March 23 and March 27. On March 25 a trough of low pressure had developed which extended from New England on the northeast to Texas on the southwest, and in which there were two centers of activity, the northernmost extended from western Pennsylvania southwestward to southern Indiana; the second center occupied northwestern Arkansas. Both of these centers delivered their quota of rain over the Ohio Valley and by the morning of March 26 had merged in a single center which overlaid western New York; meanwhile the third of the series of secondary disturbances resulting from the trough of low pressure which formed on March 25, appeared over extreme southern Texas. This last disturbance moved northeastward across the Appalachians in eastern Tennessee and Kentucky.

The development of the trough form of disturbance on March 25 resulted in two things, viz, (1) a continuation of heavy rains in the basins of the northern tributaries of the Ohio and (2) the extension of the rain area to the tributaries which enter the river along its south bank. If there had been any doubt hitherto as to the occurrence of a disastrous flood in the Ohio River proper it was removed as soon as rain began to fall in great amounts over the southern watersheds.

The period of excessive rains in the northern half of the lower Ohio watershed was 72 hours, a record which for duration and intensity has been equaled only on the Pacific coast. When the extent of territory involved and the sequence of the storms is considered, no previous record exists which is in any way comparable with that of March 23–27, 1913.

In the short space of time available it is not possible to compile extensive statistics of precipitation which shall be truly comparable with the three-day period—March 24–27, 1913. However, we have examined the records kept at the regular Weather Bureau station at Cincinnati, Ohio, the record going back to 1871. In the table given below the results of this examination appear as accumulated amounts of precipitation in 24, 48, 72, and 96 hours. The precipitation at Cincinnati for a period of 72 hours—March 24–27, inclusive—was greater than during any previous like period in the history of the station, and it is believed that a similar statement will hold for all other stations in Ohio and Indiana in the region of great rainfall between March 23 and March 27.

Heavy rainfall at Cincinnati, Ohio, 1871–1913.

[Accumulated amounts for 24, 48, 72, and 96 hours.]

Year.	Date.	Accumulated rainfall for—			
		24 hours.	48 hours.	72 hours.	96 hours.
		In.	*In.*	*In.*	*In.*
1876	Jan. 18	2.97			
1876	Jan. 27–28	1.18	3.53		
1885	Jan. 15–16	1.46	2.65		
1895	Jan. 6–7	1.53	3.81		
1898	Jan. 9	1.57			
1898	Jan. 20	1.67			
1871	Feb. 17	1.50			
1873	Feb. 16	1.53			
1874	Feb. 21	2.73			
1881	Feb. 7–8	1.00	2.01	2.92	
1882	Feb. 19–20		2.85	3.31	
1883	Feb. 4–7	1.22	1.24	2.75	3.20
1883	Feb. 10–11	1.65	1.96		
1884	Feb. 4–7	1.35	2.91	4.56	4.79
1887	Feb. 2–3	1.97	3.31		
1897	Feb. 20–22	.45	1.76	3.21	
1882	Mar. 20	2.54			
1883	Mar. 30	1.50			
1897	Mar. 5	4.97			
1913	Mar. 24–26	2.20	6.40	7.50	
1872	Apr. 8	1.62			
1876	Apr. 13	1.90			
1887	Apr. 18	1.93			
1887	Apr. 22	1.76	2.74		
1892	Apr. 18–21			2.90	3.18
1871	May 30	2.00			
1872	May 17–18		2.39		
1879	May 25–26	2.78	3.31		
1880	May 29	1.76			
1882	May 5–6	1.67	1.98		
1882	May 28	2.16			
1883	May 21	1.76			
1893	May 25	2.37			
1900	May 10	1.67			
1902	May 20	2.37			
1902	May 23	2.45			
1904	May 30–31		2.40		
1905	May 11	3.16			
1905	May 11–14	3.16	3.35	3.95	5.24
1908	May 3–6	1.48	2.17	3.23	3.91
1876	June 23	1.51			
1878	June 7–9	2.01	2.48	2.70	
1879	June 27–28	2.05	2.61		
1880	June 13–14–15	2.62	3.52	4.04	
1880	June 25–26	1.96	2.55		
1886	June 9	1.68			
1890	June 13–16	1.55	2.33	2.43	3.02
1893	June 21–22	1.05	2.05		
1896	June 23	1.64			
1902	June 28–29	1.75	2.59		
1903	June 5–6	1.72	1.85		
1906	June 26	2.18			
1872	July 15–18	1.48	2.33	2.47	2.60
1874	July 11	1.70			
1875	July 4–5	1.49	2.02		
1878	July 13	1.55			
1880	July 19	1.54			
1881	July 14	1.54			
1889	July 19	2.40			
1891	July 30	1.59			
1893	July 26	1.90			
1896	July 21	2.02			
1897	July 5	2.20			
1897	July 24–26	2.39		3.40	
1906	July 22–23	2.16	3.45		
1907	July 10–11	1.76	2.59		
1911	July 6–8	1.43	2.61	3.59	
1871	Aug. 11	2.00			
1871	Aug. 25	2.30			
1876	Aug. 5–8	1.89	2.19	2.44	2.83
1876	Aug. 17	1.65			
1879	Aug. 5–7	1.87	2.77	3.88	
1879	Aug. 23–25	1.67	2.87	3.91	
1880	Aug. 13	1.57			

Heavy rainfall at Cincinnati, Ohio, 1871–1913—Continued.

Year.	Date.	Accumulated rainfall for—			
		24 hours.	48 hours.	72 hours.	96 hours.
		In.	*In.*	*In.*	*In.*
1882..	Aug. 26–27	1.88	2.60		
1885..	Aug. 6–7	.90	2.62		
1888..	Aug. 20–21	.26	2.72		
1890..	Aug. 25	2.55			
1896..	Aug. 1	1.89			
1899..	Aug. 5–6	1.51	1.98		
1879..	Sept. 2–3	1.99	2.51		
1892..	Sept. 13	2.02			
1893..	Sept. 30	1.60			
1896..	Sept. 27–30	.68	1.93	3.67	3.98
1911..	Sept. 5	2.16			
1911..	Sept. 10–11	1.34	2.87		
1876..	Oct. 22–23	.76	2.87		
1881..	Oct. 2–3–4	.36	2.29	2.43	
1883..	Oct. 2	1.56			
1883..	Oct. 28–29	2.15	3.99		
1897..	Oct. 3	1.93			
1910..	Oct. 4–7	.26	2.59	5.41	
1874..	Nov. 22	1.82			
1875..	Nov. 13–14	1.79	2.29		
1880..	Nov. 6	1.50			
1883..	Nov. 21–22	1.81	2.94		
1890..	Nov. 11–12	.37	2.07		
1897..	Nov. 1–2	1.65	2.73		
1900..	Nov. 20	1.52			
1873..	Dec. 3	2.47			
1873..	Dec. 12	2.70			
1875..	Dec. 24–26	1.68	1.71	2.62	
1879..	Dec. 21–23	1.24	2.42	3.65	
1880..	Dec. 4–5	2.36	3.17		
1881..	Dec. 20–23	1.18	2.09	2.86	2.94
1883..	Dec. 22–24	.69	3.26	3.71	
1904..	Dec. 24–27	.43	.77	1.97	3.00

Excessive rains.—Excessive rains do not occur in Ohio as frequently as in some other parts of the United States. A count has been made of the number of rains in the State equaling or exceeding 2.50 inches in 24 hours during the 5-year period, 1890–1894. During that period the annual number ranged from 66 in 1893 to 12 in 1892, with as many as 39 in a single month, namely, in October, 1893. Other excessive rains in Ohio occurred in May, 1893, as follows:

	Inches.
Wheeler, Ohio, May 16–18, 1893	10.47
Hillhouse, Ohio, May 16–17, 1893	8.06
Strongsville, Ohio, May 16–17, 1893	6.67
North Royalton, Ohio, May 17–18, 1893	6.12
Bissels, Ohio, May 16–17, 1893	6.23

Some of the excessive rains of 24 hours' duration in Ohio are as follows:

	Inches.
Bellefontaine, Ohio, June 6, 1877	5.1
Carthagena, Ohio, June 20, 1877	5.2
Urbana, Ohio, June 21, 1877	4.9
Cleveland, Ohio, Sept. 13, 1878	4.4
Hudson, Ohio, Sept. 13, 1878	5.8
Marietta, Ohio, Sept. 13, 1878	4.6
Wooster, Ohio, July 29, 1879	6.6
Ruggles, Ohio, July 11, 1880	4.0
Ruggles, Ohio, Sept. 1, 1883	4.5
Bellefontaine, Ohio, Aug. 20, 1880	5.3
North Lewisburg, Ohio, Sept. 28, 1884	5.4
Gracey, Ohio, July 9, 1888	7.0
Newcomerstown, Ohio, July 9, 1888	4.0
Demos, Ohio, Aug. 21, 1888	4.2
Gracey, Ohio, Aug. 21, 1888	4.0
Wauseon, Ohio, May 30, 1889	6.0
Logan, Ohio, July 18, 1889	5.5

In a number of the rains above enumerated, the rate of fall was greater than during the period March 23–27, 1913. In the majority of the cases, however, the heavy rains were more or less local and consequently were not effective in producing floods in the streams. The Weather Bureau records, on the other hand, show that excessive precipitation may be widespread; thus on May 25–26, 1893, heavy thundershowers occurred over Missouri and the southern part of Illinois. That they were very general is shown by the fact that out of 100 stations in Missouri 51 of them recorded heavy rains, the average for the 51 stations being 3.67 inches, and for the 11 stations in Illinois, 3.64 inches. If all the rain which fell over Missouri in 24 hours had found its way into the Mississippi at St. Louis it would have supplied that stream for a month at a rate of discharge of 180,000 second-feet.

Other instances of widespread and heavy rains are mostly found in connection with the northward movement of storms which enter the United States from the Gulf of Mexico or the West Indies. A notable example may be found in the record of the Gulf of Mexico storm of October 18–20, 1894. The record of the storm also shows an abatement in the intensity of the rainfall over the Carolinas, Maryland, and Virginia, and an increase in intensity over New Jersey and the southern New England coast, thus:

	Inches.
Average amount in Florida, Oct. 18–19, 3 stations	5.10
Average amount in Georgia, Oct. 17–18, 7 stations	3.75
Average amount in the Carolinas, Oct. 17–18, 15 stations	3.30
Average amount in New Jersey, Oct. 18–19, 24 stations	4.81
Average amount in Massachusetts and Connecticut, Oct. 19–20, 18 stations	3.44
Average amount in Maine, Oct. 19–20, 3 stations	3.35

The point it is desired to illustrate in this connection is that nearness to the ocean, or remoteness therefrom, is evidently not the only factor concerned in the occurrence of heavy rains, although it must be one of the controlling factors.

The floods in the tributaries of the Ohio.—The surface conditions preceding the period of heavy rains throughout the Ohio Valley were favorable to a large run-off. The ground was not frozen, but light rains had fallen only two days previous to the advent of the rains hereinbefore discussed, the ground having had but a short time in which to dry out, must have been quickly saturated early in the period of intense rain, consequently all of the streams in the region of heavy rains reached their full capacity early on March 24; thenceforward it was only a question of a further continuation of rain when they should overflow their banks.

What proportion of the overflow from the streams of Ohio was due to encroachments on the channels of said streams, the building of bridges, and the drainage of swamp lands, can not, of course, be easily determined; in the opinion of the writer, however, it is idle to look elsewhere for the immediate cause of the floods than in the amount of rain which fell over the State.

One of the greatest floods in the Ohio at Pittsburgh, Pa., occurred in 1832, at a time when the hand of man had scarcely touched the surface of the watershed. The year of the "great water" in Missouri and Illinois Rivers dates back to 1844, when, as above mentioned, the effects of modern civilization in restraining the free flow of the rivers could not have been appreciable. The manifest lesson of the present flood is that it was due to a combination of meteorological conditions which may recur, although the probability of a repetition is not great.

The first advices received by the Weather Bureau officials in the various sections affected were uniformly to the effect that the rivers were bank full and rising rapidly. Such advices were received as early as March 24, and warnings were sent to Dayton and Hamilton, Ohio, on that date. Warnings were also issued on the 25th and up to the 26th. The disastrous stages in the Great Miami River occurred on the early morning of March 25; the time of maximum flood stages in other of the rivers of Ohio was as follows: Scioto at Columbus, Ohio, about noon March 25; Muskingum at Zanesville, Ohio, probably on March 26-27; Mahoning at Youngstown, Ohio, water overtopped gauge on March 26 and continued above it on the 27th and 28th; Maumee at Napoleon, Ohio, on March 26; Sandusky at Fremont, Ohio, on March 26–27.

Date of maximum stages in Indiana rivers.—Wabash at Bluffton, Ind., on March 26; at Attica, Ind., on March 27; at Terre Haute, Ind., on March 27; and at Mount Carmel, Ill., on March 30; West Fork of White at Anderson, Ind., on March 26; at Indianapolis, Ind., on March 26; East Fork of White at Shoals, Ind., on March 28.

Date of maximum stages in Illinois rivers.—Illinois at La Salle, Ill., on March 29; at Peoria, Ill., on March 30–31; and at Beardstown, Ill., on April 6. The movement of the water in the Illinois River is extremely slow.

Date of maximum stages in Kentucky rivers.—Licking at Falmouth, Ky., on March 27; Kentucky at High Bridge, Ky., on March 27; at Beattyville, Ky., on March 28, and at Frankfort, Ky., on March 28.

Date of maximum stages in West Virginia rivers.—Big Sandy, Levisa Fork, at Pikeville, Ky., on March 27; Big Sandy, Tug Fork, at Williamson, W. Va., on March 27; at Lock No. 3, Ky., on March 28; New-Great Kanawha, at New River, Tenn., on March 27; at Radford, Va., on March 28; at Hinton, W. Va., on March 28; and at Charleston, W. Va., on March 28; Little Kanawha at Glenville, W. Va., on March 27.

Thus it will be seen that the maximum stages on the Ohio tributaries from the south occurred on an average of about a day later than on the northern tributaries, due as before explained to different rainfall distribution. Moreover the maximum stages on the rivers of Ohio, without exception, exceeded by from 1 to 15 feet the previous highest stages of which there is authentic record; on the other hand the floods in the southern tributaries failed to reach previous high stages, due to the lesser amount of precipitation and the shorter time of its continuance.

Outside of the region under discussion the rainfall was appreciably smaller in amount, yet sufficient to produce record-breaking floods, particularly in New York State, where, on March 27–28, floods prevailed, exceeding, in the case of the Genesee at Rochester, the memorable flood of 1865, and in the case of the Hudson at Albany, the flood waters of 1857. The Connecticut River marked the eastern advance of the floods, and the James River of Virginia, the southern.

Flood in the Ohio River.—The Ohio River at Pittsburgh crested at 30.4 feet on March 28, a less stage than had been reached earlier in the year; at Wheeling, W. Va., the maximum stage was 51 feet, 6.9 feet above the January flood of 1913. At Parkersburg, W. Va., a crest stage of 58.9 feet, 5 feet above the highest known stage, that of 1884, was reached on March 28.

The Ohio River began to receive water from the flooded streams of the watershed as early as March 26, when a rise of 21 feet in 24 hours was registered at Cincinnati, Ohio. The Muskingum put forth an enormous volume of water on the 28th, causing a rise in the Ohio at Parkersburg, W. Va., of 11.9 feet in 24 hours, on an initial stage of 43 feet; the crest stage at the last-named place did not occur however until the 29th. By this time the flood wave in the Ohio River was much flattened and consequently very long. Points between Parkersburg and Cincinnati experienced stages generally above the previous high water mark of 1884. The crest of the flood after passing Parkersburg, W. Va., moved rather rapidly, reaching Cincinnati on April 1, with a reading of 69.8 feet, 1.3 feet below the previous maximum stage of 71.1 feet in 1884.

The history of the Ohio flood from Cincinnati to Cairo, and the consequent flood in the lower Mississippi, will form a part of the April, 1913, Review.

Distribution of precipitation.—In order to better realize the horizontal distribution of the precipitation a small chart has been prepared which shows the total rainfall in the Ohio Valley watershed for the five days, March 23–27, inclusive, see chart at end of this article. Numerical values of the daily precipitation and the daily river stages are given in the tables which follow. The rainfall statistics are presented alphabetically by States; the river stages by drainage areas. There is necessarily some lack of agreement among the daily precipitation values by reason of the different daily time periods used. (See note on Table of Daily Precipitation.)

Daily amounts of precipitation (in inches and hundredths) at representative stations in the watershed of the Ohio River, March 23–27, 1913.[1]

	Mar. 23.	Mar. 24.	Mar. 25.	Mar. 26.	Mar. 27.	Total.
WESTERN PENNSYLVANIA.						
Regular stations (midnight to midnight):						
Pittsburgh	0.20	0.72	0.55	1.66	0.38	3.51
Erie	1.28	1.38	2.12	0.91	0.58	6.27
Special river stations (7 a. m. to 7 a. m.):						
Beaver Falls	0.00	0.59	1.65	1.79	0.92	4.95
Confluence	0.00	0.00	0.00	1.00	0.76	1.76
Ellwood City	0.00	0.69	1.81	1.61	0.92	5.03
Franklin	0.00	1.41	2.22	1.32	0.88	5.83
Freeport	0.00	0.14	1.53	1.15	0.35	3.17
Greensboro	0.00	0.06	0.04	1.40	1.12	2.62
Lock No. 4	0.00	0.08	0.05	1.50	0.64	2.27
Mosgrove	0.00	0.19	1.77	1.93	0.67	4.56
Parker	0.01	0.62	2.25	1.40	1.25	5.53
Saltsburg	0.00	0.05	0.20	1.50	0.77	2.52
Sharon	0.00	1.19	2.92	1.24	0.84	6.19
Warren	0.00	0.70	1.70	1.36	1.10	4.86
West Newton	0.00	0.10	0.07	1.62	0.64	2.43
Cooperative stations (7 p. m. to 7 p. m.):						
Aleppo	0.10	0.08	0.58	1.09	0.97	2.82
Claysville	0.15	0.17	0.58	1.51	1.02	3.43
Clearfield	0.00	0.64	0.31	1.09	0.90	2.94
Greenville	1.34	1.11	3.74	0.95	0.60	7.74
Indiana	0.23	0.62	0.26	1.17	0.80	3.08
Saegerstown	1.00	1.09	3.70	0.74	0.98	7.51
OHIO.						
Regular stations (midnight to midnight):						
Cincinnati	0.00	2.21	4.15	1.11	0.00	7.47
Cleveland	1.94	1.46	2.66	0.91	0.25	7.22
Columbus	0.53	2.14	2.89	1.40	0.01	6.97
Toledo	1.90	1.82	1.74	0.48	0.25	6.19
Special river stations (7 a. m. to 7 a. m.):						
Kings Mills	0.00	0.69	2.57	4.06	1.22	8.54
Portsmouth	0.00	T.	0.03	2.78	1.40	4.21
Upper Sandusky	0.00	2.00	2.15	3.50	1.19	8.84
Cooperative stations (7 p. m. to 7 p. m.):						
Antwerp	2.45	0.85	2.50	0.12	0.55	6.47
Bangorville	0.90	1.95	5.25	1.55	0.91	10.56
Bellefontaine	1.37	1.52	5.61	2.13	0.53	11.16
Benton Ridge	2.36	2.00	2.64	0.24	0.30	7.54
Bowling Green	2.00	1.50	2.00	0.30	0.25	6.05
Cambridge	0.33	1.09	1.87	2.55	0.88	6.72
Canal Dover	0.62	0.30	2.70	1.35	0.75	5.72
Canton	1.03	2.20	3.00	1.62	0.60	8.45
Circleville	0.15	1.50	1.97	2.29	0.37	6.28
Conneaut	0.90	1.23	2.86	0.97	0.85	6.81
Dayton	0.51	2.91	3.28	1.48	0.76	8.94
Frankfort	T.	1.20	1.67	2.20	1.42	6.49
Fremont	2.50	0.72	2.80	0.20	0.94	7.16
Garrettsville	1.98	1.03	4.61	0.88	0.87	9.37
Granville	0.49	1.43	2.68	2.06	0.50	7.16
Greenville	1.29	1.77	4.45	1.41	0.41	9.33
Hudson	1.60	1.90	4.10	1.15	0.90	9.65
Marion	1.38	1.97	4.39	1.87	1.00	10.61
Millport	0.75	0.90	1.90	1.35	0.70	5.60
Philo	0.36	1.36	1.46	2.29	0.70	6.17
Tiffin	1.98	1.12	3.65	0.47	0.75	7.97
Urbana	0.62	2.13	3.12	2.25	0.54	8.66
Wauseon	2.07	1.14	1.78	0.32	0.34	5.65
Wooster	1.16	1.94	4.84	1.40	0.81	10.15

[1] *Important.*—The daily amounts of precipitation at regular Weather Bureau stations are given from midnight to midnight, seventy-fifth meridian time. At special river stations the amounts include the precipitation which occurred between 7 a. m. of one day and 7 a. m. of the following day, local time, while the amounts at cooperative stations include the precipitation from 7 p. m. of one day to 7 p. m. of the following day, local time.

Daily amounts of precipitation (in inches and hundredths) at representative stations in the watershed of the Ohio River, March 23–27, 1913—Contd.

	Mar. 23.	Mar. 24.	Mar. 25.	Mar. 26.	Mar. 27.	Total.
WEST VIRGINIA.						
Regular stations (midnight to midnight):						
Elkins	0.00	0.00	0.22	0.49	0.70	1.41
Parkersburg	0.08	0.05	0.80	1.84	0.24	3.01
Special river stations (7 a. m. to 7 a. m.):						
Charleston	0.00	0.00	0.00	1.20	1.35	2.55
Creston	0.00	0.00	0.00	1.60	1.47	3.07
Fairmont	0.00	0.03	0.02	1.28	0.92	2.25
Glenville	0.00	0.00	0.00	1.15	1.20	2.35
Hinton	0.00	0.00	0.00	0.62	1.74	2.36
Huntington	0.00	0.00	0.00	2.24	1.90	4.14
Point Pleasant	0.00	0.00	0.20	1.80	1.18	3.18
Rowlesburg	0.00	0.00	0.00	0.90	0.90	1.80
St. Marys	T.	0.19	0.00	1.63	1.00	2.82
Wheeling	0.00	0.18	0.53	1.86	0.50	3.07
Williamson	0.00	0.00	0.00	0.78	1.70	2.48
Cooperative stations (7 p. m. to 7 p. m.):						
Beckley	0.00	0.00	0.00	0.95	1.40	2.35
Bens Run	0.20	0.00	0.52	1.21	0.77	2.70
Cuba	0.00	0.30	0.28	1.48	0.95	3.01
Elkhorn	0.00	0.00	0.97	2.05	0.05	3.07
Grafton	0.00	0.00	0.35	0.80	1.05	2.20
Ryan	0.00	0.00	0.36	1.40	1.29	3.05
Wellsburg	0.23	0.41	0.76	1.83	0.78	4.01
KENTUCKY.						
Regular stations (midnight to midnight):						
Lexington	0.00	0.21	1.79	2.46	0.01	4.47
Louisville	T.	0.15	4.95	0.87	T.	5.97
Special river stations (7 a. m. to 7 a. m.):						
Beattyville	0.00	0.00	0.00	3.04	3.28	6.32
Burnside	0.00	0.00	0.00	2.25	3.25	5.50
Catlettsburg	0.00	0.00	0.00	2.36	0.92	3.28
Falmouth	0.00	0.00	0.30	3.23	0.96	4.49
Frankfort	0.00	0.00	0.11	3.35	1.06	4.52
High Bridge	0.00	0.00	0.05	3.02	1.24	4.31
Maysville	0.00	T.	0.16	2.03	1.29	3.48
Paducah	0.00	0.00	1.20	3.64	0.40	5.24
Pikeville	0.00	0.00	0.00	0.80	1.40	2.20
Williamsburg	0.00	0.00	0.00	2.02	2.05	4.07
Cooperative stations (7 p. m. to 7 p. m.):						
Anchorage	0.00	0.20	3.50	1.72	0.08	5.50
Berea	0.00	0.00	1.20	5.25	0.60	7.05
Calhoun	0.00	T.	1.40	2.46	0.13	3.99
Edmonton	0.00	0.00	0.00	4.30	0.09	4.39
Franklin	0.00	0.20	0.00	4.85	T.	5.05
Hopkinsville	0.00	0.20	0.32	2.53	0.10	3.15
Irvington	0.00	0.05	3.75	1.80	0.20	5.80
Marion	0.00	T.	2.28	1.43	T.	3.71
Middlesboro	0.00	0.00	0.00	1.75	1.60	3.35
Scott	T.	2.86	1.50	2.38	0.23	6.97
Shelby City	0.00	0.00	0.61	4.16	0.39	5.16
INDIANA.						
Regular stations (midnight to midnight):						
Evansville	0.29	0.90	4.01	0.30	0.02	5.52
Fort Wayne	2.08	1.98	0.69	0.40	0.21	5.36
Indianapolis	1.27	2.76	1.56	0.34	0.08	6.01
Terre Haute	1.05	2.45	0.77	0.19	0.10	4.56
Special river stations (7 a. m. to 7 a. m.):						
Attica	0.37	2.80	2.28	0.00	0.63	6.08
Bluffton	0.00	3.80	3.00	0.10	0.60	7.50
Elliston	0.00	1.10	6.10	1.20	0.20	8.60
Madison	0.36	2.74	3.67	2.27	T.	9.04
Mount Vernon	0.00	0.21	1.65	2.55	0.37	4.78
Shoals	T.	0.37	6.66	1.80	0.45	9.28
Cooperative stations (7 p. m. to 7 p. m.):						
Anderson	2.34	1.50	2.51	0.50	0.14	6.99
Berne	2.30	2.34	2.56	0.42	0.19	7.81
Butlerville	0.14	2.57	4.43	1.56	0.57	9.27
Collegeville	1.20	1.14	1.86	0.20	0.00	4.40
Connersville	0.68	1.85	5.67	1.46	0.32	9.98
Crawfordsville	2.80	2.30	2.20	0.70	0.00	8.00
Eminence	1.60	1.95	1.45	0.25	0.00	5.25
Farmersburg	0.78	1.92	2.23	0.21	T.	5.14
Greenfield	1.25	2.56	2.32	1.00	0.15	7.28
Huntingburg	2.27	4.50	0.52	0.00	0.00	7.29
Huntington	1.80	1.05	1.95	0.30	0.30	5.40
Judyville	1.97	1.13	1.51	0.27	0.14	5.02
Kokomo	2.18	1.57	1.97	0.00	0.38	6.10

	Mar. 23.	Mar. 24.	Mar. 25.	Mar. 26.	Mar. 27.	Total.
INDIANA—continued.						
Cooperative station (7 p. m. to 7 p. m.)—Continued.						
Mauzy	0.56	2.25	5.59	0.98	0.27	9.65
Moores Hill	0.33	1.63	2.78	2.10	0.08	6.92
Princeton	0.05	2.00	4.37	1.05	0.06	7.53
Rome	0.00	0.10	3.13	2.46	0.09	5.78
Salamonia	3.55	1.16	3.04	1.08	0.21	9.04
Salem	0.10	2.00	3.10	1.10	0.20	6.50
South Bend	1.15	0.53	0.88	0.60	0.18	3.34
Underwood	0.01	2.10	3.30	2.30	0.21	7.92
SOUTHERN ILLINOIS.						
Regular stations (midnight to midnight):						
Cairo	0.04	0.02	4.29	0.24	0.02	4.61
Special river stations (7 a. m. to 7 a. m.):						
Shawneetown	0.00	0.52	1.62	2.44	0.74	5.32
Chester	0.00	0.62	2.80	0.22	0.82	4.46
Mount Carmel	T.	0.86	6.20	1.50	0.60	9.16
Cooperative stations (7 p. m. to 7 p. m.):						
Albion	T.	2.10	6.23	0.71	0.07	9.11
Carbondale	0.00	0.25	4.24	0.52	0.07	5.08
Carlyle	T.	1.60	1.92	0.58	T.	4.10
Danville	2.20	1.35	1.40	0.54	0.23	5.72
Equality	T.	0.27	3.02	0.97	T.	4.26
Flora	T.	2.38	3.30	0.40	0.11	6.19
Manteno	1.34	0.29	0.45	0.15	0.07	2.30
Metropolis	0.00	0.35	3.74	1.25	0.05	5.39
Palestine	0.16	1.34	3.67	0.40	0.00	5.57
Tuscola	2.05	1.22	1.23	0.42	0.08	5.00
WESTERN VIRGINIA.						
Regular stations (midnight to midnight):						
Lynchburg	0.00	0.00	0.00	0.27	0.54	0.81
Wytheville	0.00	0.00	0.00	1.70	0.88	2.58
Special river stations (7 a. m. to 7 a. m.):						
Buchanan	0.00	0.00	0.00	0.00	2.20	2.20
Speers Ferry	0.00	0.00	0.00	0.26	2.00	2.26
NORTHERN ALABAMA.						
Special river stations (7 a. m. to 7 a. m.):						
Bridgeport	0.00	0.00	0.00	0.00	1.86	1.86
Florence	0.00	0.00	0.00	0.25	1.44	1.69
Guntersville	0.00	0.00	T.	0.10	0.72	0.82
WESTERN NORTH CAROLINA.						
Regular station (midnight to midnight):						
Asheville	0.00	0.01	0.09	0.69	0.40	1.19
TENNESSEE.						
Regular stations (midnight to midnight):						
Chattanooga	0.00	0.00	0.10	1.58	0.03	1.71
Knoxville	0.00	0.00	0.08	2.18	0.16	2.42
Memphis	0.08	0.00	1.23	0.56	T.	1.87
Nashville	0.00	T.	1.11	1.85	0.01	2.97
Special river stations (7 a. m. to 7 a. m.):						
Carthage	0.00	0.00	0.01	4.50	1.90	6.41
Celina	0.00	0.00	0.00	4.20	2.16	6.36
Clarksville	0.00	T.	0.53	3.47	1.26	5.26
Elizabethton	0.00	0.00	0.00	1.00	1.60	2.60
Johnsonville	0.00	0.10	0.86	4.00	0.64	5.60
Kingston	0.00	0.00	0.00	0.22	2.86	3.08
Newport	0.00	0.00	0.00	T.	1.75	1.75
New River	0.00	0.00	0.00	1.42	2.54	3.96
Cooperative stations (7 p. m. to 7 p. m.):						
Ashwood	0.00	0.00	T.	2.50	0.00	2.50
Benton	0.00	0.00	T.	0.53	0.75	1.28
Byrdstown	0.00	0.00	0.00	0.00	3.70	3.70
Cedar Hill	0.00	0.30	0.20	4.72	0.15	5.37
Dover	0.00	0.24	0.91	2.67	T.	3.82
Erasmus	0.00	T.	0.33	2.07	0.92	3.32
Jackson	0.00	0.00	0.04	2.75	T.	2.79
Kenton	0.00	0.24	0.48	1.79	0.01	2.52
McMinnville	0.00	0.00	0.00	1.25	1.85	3.10
Mountain City	0.00	0.00	0.00	0.63	1.23	1.86
Rogersville	0.00	0.00	0.00	0.33	2.13	2.46
Savannah	0.00	0.48	0.63	5.95	0.04	7.10

Daily river gage readings (in feet and tenths) Mar. 22–29, 1913, and crest stages as compared with previous highest water at special river stations in the watershed of the Ohio.

	Flood stage (feet).	Previous highest stage.		March, 1913.								1913		Compared with previous highest.
		Height.	Date.	22	23	24	25	26	27	28	29	Highest.	Date.	
LAKE ERIE SYSTEM.														
Sandusky River:														
Tiffin, Ohio	7	18.5	Apr. 2, 1904	2.4	2.4	7.0	12.5	19.4†	16.0†	12.0†	8.0†	19.4	Mar. 26	+0.9
Fremont, Ohio	10	16.5	—— —, 1904	......	......	9.4	13.5	21.5	21.5	14.3	11.0	21.5	...do.....	+5.0
Maumee River:														
Fort Wayne, Ind	15	22.5	Mar. 8, 1908	7.0	6.7	19.6	[a] 24.0	26.0	26.0	25.1	23.7	26.1	...do.....	+3.6
Napoleon, Ohio	13	18.8	Mar. 2, 1910	1.0	0.8	9.2	16.0	22.0	25.0	22.5	18.0	25.0	Mar. 27	+6.2
OHIO RIVER SYSTEM.														
Clarion River:														
Clarion, Pa	10	16.0	Mar. 20, 1905	2.7	2.4	3.2	13.5	12.0	12.3	10.2	7.2	13.9	Mar. 25	−2.1
Conemaugh-Kiskiminetas:														
Johnstown, Pa	7	21.0	May 31, 1889	2.8	2.6	2.5	2.5	3.0	5.5	4.6	4.0	5.5	Mar. 27	−15.5
Saltsburg, Pa	6	22.1	—— —, 1859	1.3	1.2	1.0	1.0	1.6	6.2	6.3	4.2	7.7	...do....	−14.4
Allegheny River:														
Olean, N. Y	12	19.3	June 1, 1889	2.2	2.0	2.7	6.6	14.0	14.4	15.2	12.6	15.6	...do.....	+ 3.7
Warren, Pa	14	17.4	Mar. —, 1865	2.4	2.2	3.8	8.0	14.1	14.8	14.1	12.5	15.2	...do.....	− 2.2
Franklin, Pa	15	15.4	Apr. 30, 1909	3.5	3.2	6.1	11.6	22.0	21.1	19.5	15.3	22.5	Mar. 26	− 7.1
Parker, Pa	20	28.0	Mar. —, 1865	3.8	3.2	5.0	15.4	24.5	24.5	23.0	17.0	25.7	...do....	− 2.3
Freeport, Pa	20	32.7	Feb. 18, 1891	6.5	6.2	5.9	16.2	26.4	31.9	29.5	23.5	32.2	Mar. 27	− 0.5
Springdale, Pa	27	33.0	Mar. 16, 1908	11.9	11.4	11.2	19.0	30.0	36.5	34.3	28.3	36.5	...do.....	+ 3.5
Cheat River:														
Rowlesburg, W. Va	14	22.0	July 10, 1888	3.3	3.3	3.2	3.2	3.1	5.5	7.7	5.5	7.7	Mar. 28	−14.3
Youghiogheny River:														
Confluence, Pa	10	18.6	Mar. 14, 1907	1.6	1.3	1.3	1.1	1.6	4.9	4.8	3.5	5.6	Mar. 27	−13.0
West Newton, Pa	23	30.6	Feb. 27, 1912	2.0	1.8	1.5	1.3	2.2	7.4	8.5	5.7	9.7	...do.....	−20.9
Monongahela River:														
Fairmont, W. Va	25	37.0	July 10, 1888	15.1	15.0	14.9	14.8	14.8	20.2	22.4	19.1	23.6	...do.....	−13.4
Greensboro, Pa	18	39.0	.....do.......	8.0	7.9	7.8	7.7	8.0	14.6	18.7	13.6	18.7	Mar. 28	−20.3
Lock No. 4, Pa	28	42.0	July 11, 1888	8.8	8.5	8.2	9.0	10.0	16.2	25.2	20.2	25.2	...do.....	−16.8
Mahoning River:														
Youngstown, Ohio	5	15.8	Jan. 21, 1904	0.6	0.5	4.7	15.5	[1] 22.9	......	......	10.4	[2] 22.9	Mar. 26	+ 7.1
Beaver River:														
Beaver Falls, Pa	11	15.4	Jan. 22, 1904	4.6	4.4	6.6	13.2	16.7	17.4	15.1	12.0	17.4	Mar. 27	+ 2.0
Tuscarawas River:														
Canal Dover, Ohio	8	12.0	....	......	......	2.3	7.0	13.0	15.0	16.1	9.0	16.1	Mar. 28	+ 4.1
Muskingum River:														
Coshocton, Ohio	8	22.0	Mar. 24, 1898	1.0	1.2	2.5	11.0	......	......	......	......	[3] 20.0	Mar. 25	− 2.0
Zanesville, Ohio	25	36.8	.....do.....	9.9	9.7	9.9	21.2	......	51.8	......	......	51.8	Mar. 27	+15.0
Beverly, Ohio	25	35.0	Mar. —, 1898	7.9	7.6	7.7	16.6	......	46.5	......	......	46.5	...do.....	+11.5
Little Kanawha River:														
Glenville, W. Va	20	21.2	Jan. 9, 1907	1.6	1.4	1.4	1.6	2.0	15.2	11.0	3.2	20.0	...do.....	− 1.2
Creston, W. Va	20	25.8	Apr. 20, 1901	3.1	3.1	2.9	2.8	4.2	16.0	18.9	9.5	20.4	Mar. 28	− 5.4
New-Great Kanawha:														
Radford, Va	14	34.0	Sept. 15, 1878	1.4	1.2	1.1	1.0	1.0	7.3	9.8	4.2	11.5	Mar. 27	−22.5
Hinton, W. Va	14	23.0	Sept. 13, 1878	3.2	3.1	3.0	2.9	2.8	6.5	11.6	7.2	14.5	Mar. 28	− 8.5
Charleston, W. Va	30	46.9	Sept. 29, 1861	6.0	5.9	5.7	5.5	5.5	10.2	33.0	30.0	34.8	...do....	−12.1
Big Sandy River:														
Williamson, W. Va	26	24.5	June 14, 1907	3.7	3.4	3.2	3.1	3.2	26.4	18.0	8.9	30.4	Mar. 27	− 5.9
Pikeville, Ky	40	39.5	Aug. —, 1903	5.1	5.0	4.9	4.8	4.5	34.0	21.5	10.4	39.0	...do....	− 0.5
Scioto River:														
Columbus, Ohio	17	21.3	Mar. 23, 1898	4.4	4.8	6.2	21.9	20.9	19.7	17.4	14.7	22.9	Mar. 25	+ 1.6
Circleville, Ohio	12	19.3	July 17, 1884	......	......	......	11.6	24.2	20.3	16.2	13.8	24.2	Mar. 26	− 4.9
Chillicothe, Ohio	14	28.3	Mar. 24, 1898	1.6	1.6	1.6	11.9	......	......	......	24.6	37.8	...do....	− 9.5
Licking River:														
Falmouth, Ky	25	38.0	—— —, 1854	3.9	4.2	4.0	3.6	29.1	33.8	32.2	23.6	34.1	Mar. 27	− 3.9
Miami River:														
Dayton, Ohio	18	21.3	—— —, 1866	3.0	3.0	7.0	[4] 24.0	[5] 28.1	[5] 22.2	[5] 15.7	11.6	29.0	Mar. 25	+ 7.7
Hamilton, Ohio	12	21.2	Mar. 24, 1898	3.0	3.0	4.8	19.6	......	25.0	19.2	14.8	34.6	Mar. 26	+13.4
Little Miami River:														
Kings Mills, Ohio	17	......	....	......	......	3.3	17.8	33.7	......	......	......	33.7	Mar. 26	......
Kentucky River:														
Beattyville, Ky	30	37.5	Mar. 1, 1903	0.9	0.8	1.6	2.0	11.6	37.0	38.6	19.5	39.9	Mar. 28	+ 2.4
High Bridge, Ky	17	30.0	Jan. 30, 1902	11.5	11.4	11.3	11.1	21.0	34.6	33.4	33.5	34.6	Mar. 27	+ 4.6
Frankfort, Ky	31	44.0	Feb. —, 1878	8.6	8.7	8.5	8.5	15.8	35.2	38.3	37.5	38.3	Mar. 28	− 5.7
White River:														
Anderson, Ind	9	18.8	Mar. 23, 1904	4.3	3.8	11.8	17.6	20.6	14.0	10.2	7.8	22.1	Mar. 25	+ 3.3
Indianapolis, Ind	12	19.5	Apr. 1, 1904	4.7	......	11.0	18.0	......	......	......	......	25.7	...do....	+ 6.2
Elliston, Ind	21	29.6	Mar. 5, 1897	......	......	11.8	23.8	27.8	31.3	30.4	28.6	31.3	Mar. 27	+ 1.7
Shoals, Ind	20	34.1	Mar. 30, 1904	7.4	8.0	8.8	21.6	29.5	37.0	42.2	41.7	42.2	Mar. 28	+ 8.1
New River:														
New River, Tenn	25	33.0	Feb. —, 1903	3.2	2.9	2.6	2.4	4.1	23.5	5.6	3.9	23.5	Mar. 27	− 9.5
Wabash River:														
Bluffton, Ind	12	16.7	Apr. —, 1904	3.2	2.5	12.3	17.5	20.0	19.0	13.8	12.3	20.0	Mar. 26	+ 3.3
Logansport, Ind	12	17.3	Feb. —, 1883	3.6	3.8	12.1	......	†22.5	......	......	......	22.5	....do....	+ 5.2
Attica, Ind	12	29.7	Aug. 3, 1875	6.2	6.8	15.9	24.6	31.6	33.4	31.6	28.5	33.4	Mar. 27	+ 3.7
Terre Haute, Ind	16	27.7	Feb. 18, 1883	7.1	7.0	14.5	19.5	27.0	31.2	30.8	29.2	31.3	....do...	+ 3.6
Mount Carmel, Ill	15	28.3	Aug. 7, 1885	11.9	13.4	13.6	18.3	21.4	23.0	24.8	27.8	31.0	Mar. 30	+ 2.7
Cumberland River:														
Burnside, Ky	50	65.0	Mar. 30, 1902	8.7	10.5	9.1	8.2	15.2	57.2	58.0	40.0	61.5	Mar. 28	− 3.5
Carthage, Tenn	40	54.3	Apr. 7, 1886	15.8	16.4	15.7	15.5	21.0	37.5	43.9	47.0	47.0	Mar. 29	− 7.3
Nashville, Tenn	40	55.3	Jan. 22, 1882	21.5	17.4	17.5	16.2	25.0	39.3	42.7	42.8	44.9	Apr. 2	−10.4
Clarksville, Tenn	46	60.6	Jan. —, 1882	29.7	24.4	20.6	20.1	31.6	47.3	50.5	50.5	50.9	Mar. 28	− 9.7
Clinch River:														
Speers Ferry, Va	20	26.6	Feb. 28, 1902	2.6	2.4	2.0	1.6	1.0	12.0	17.5	7.2	18.2	Mar. 27	− 8.4
Clinton, Tenn	25	45.0	Mar. 31, 1886	9.4	8.7	8.2	7.8	7.6	23.4	26.5	29.9	30.2	Mar. 29	−14.8
Holston River:														
Rogersville, Tenn	14	17.5	Jan. 23, 1906	4.0	3.9	3.6	3.4	3.3	7.4	19.1	8.5	19.1	Mar. 28	+ 1.6
French Broad River:														
Dandridge, Tenn	12	28.0	May 21, 1901	4.9	3.5	3.1	3.0	2.9	8.5	12.2	8.4	16.0	....do....	−12.0
Hiwassee River:														
Charleston, Tenn	22	32.2	Mar. 31, 1886	10.0	6.4	5.2	4.8	5.2	13.2	20.0	14.5	20.3	....do....	−11.9
Little Tennessee River:														
McGhee, Tenn	20	39.0	Mar. —, 1867	8.8	6.8	6.2	5.9	5.9	13.8	17.5	11.2	21.6	Mar. 27	−17.4

Daily river gage readings (in feet and tenths) Mar. 22–29, 1913, and crest stages as compared with previous highest water at special river stations in the watershed of the Ohio—Continued.

	Flood stage (feet).	Previous highest stage.		March, 1913.								1913		Compared with previous highest.
		Height.	Date.	22	23	24	25	26	27	28	29	Highest.	Date.	
OHIO RIVER SYSTEM—continued.														
Tennessee River:														
Knoxville, Tenn	12	39.0	Mar. —, 1875	4.5	4.8	4.2	3.5	3.2	7.3	20.9	20.1	21.6	Mar. 28	−17.4
Chattanooga, Tenn	33	58.6	Mar. 11, 1867	12.9	12.9	12.3	11.2	10.1	13.3	25.4	31.2	33.3	Mar. 30	−25.3
Bridgeport, Ala	24	41.0	—— — 1867	11.2	7.0	10.4	9.4	8.5	9.2	16.4	20.6	23.7	Mar. 31	−17.3
Florence, Ala	16	32.5	Mar. 19, 1897	18.0	16.0	13.7	12.0	10.7	13.7	14.0	15.7	18.5	Mar. 21	−14.0
Johnsonville, Tenn	31	48.0	Mar. 24, 1897	27.5	28.0	28.5	28.4	29.4	32.1	33.0	33.3	33.3	Mar. 29	−14.7
Ohio River:														
Pittsburgh, Pa	22	35.5	Mar. 15, 1907	5.3	4.8	4.5	7.8	20.1	28.1	30.4	24.8	30.4	Mar. 28	− 5.1
Wheeling, W. Va	36	53.1	Feb. 7, 1884	8.8	8.3	7.5	11.5	30.5	45.5	50.8	50.0	51.1	....do....	− 2.0
Parkersburg, W. Va	36	53.9	Feb. 9, 1884	10.5	10.0	9.5	10.0	22.1	43.0	54.9	58.7	58.9	Mar. 29	+ 5.0
Point Pleasant, W. Va	39	60.0	Feb. —, 1884	14.1	12.3	11.1	10.1	13.2	34.1	50.6	60.2	62.8	Mar. 30	+ 2.8
Huntington, W. Va	50	64.8	Feb. 9, 1884	19.7	17.9	16.1	14.1	17.2	39.4	54.5	63.8	66.4	....do....	+ 1.2
Catlettsburg, Ky	50	72.0	Feb. 12, 1884	19.5	17.3	13.8	15.5	17.2	41.1	56.8	65.1	67.7	Mar. 31	− 4.3
Portsmouth, Ohio	50	66.3	.....do	21.5	19.1	17.4	16.1	21.9	51.0	61.9	62.8	67.9	....do....	+ 1.3
Maysville, Ky	50	65.7	Feb. 14, 1884	23.1	20.3	18.4	17.1	28.8	44.3	57.5	62.8	66.4	....do....	+ 0.7
Cincinnati, Ohio	50	71.1	.....do	27.5	24.7	22.6	29.3	50.3	57.2	62.6	66.0	69.8	Apr. 1	− 1.3
Madison, Ind	46	61.8	Feb. 15, 1884	25.1	23.6	21.6	27.5	43.5	53.6	57.0	59.6	62.8	....do ...	+ 1.0
Louisville, Ky	28	46.7	.....do	11.3	10.8	10.0	11.4	22.5	33.6	38.4	41.1	44.9	Apr. 2	− 1.8
Evansville, Ind	35	48.0	Feb. 19, 1884	28.4	28.3	27.5	26.0	30.1	36.6	40.4	43.0	48.4	Apr. 5	+ 0.4
Shawneetown, Ill	35	56.4	Feb. 24, 1884	29.3	29.6	29.3	28.9	31.1	34.9	38.3	41.9	59.5	....do ...	+ 3.1
Paducah, Ky	43	54.2	Feb. 23, 1884	33.6	34.3	34.4	34.3	36.9	38.5	40.7	42.6	54.3	Apr. 7	+ 0.1
Cairo, Ill	45	54.0	Apr. 6, 1912	39.0	39.9	40.3	40.9	43.5	45.5	47.4	49.1	54.8	Apr. 4, 7	+ 0.8

† Estimated.
[a] Dyke broke on 25th and flood waters passed around the gauge, subsequent readings not comparable with preceding ones.
[1] About 22.9.
[2] No record after the 26th.
[3] Obtained by survey.
[4] Approximated.
[5] Measurements made at Viaduct Bridge

As indicated in the preceding text the northeastward advance of the rain area which deluged the Ohio Basin caused damaging floods in New York State and western New England. The volume of water in the Genesee River at Rochester was greater than in the record flood of 1865, but beyond flooding many cellars and basements in Rochester, no large amount of damage was wrought. The flood conditions in the Hudson at Albany and Troy, N. Y., were the cause of general interruption to business in the establishments situated within reach of the flood waters, including power plants and a total suspension of city and interurban trolley lines. The river at Albany reached a stage of 22.4 feet on March 28, 1.2 feet higher than the record flood of February 9, 1857.

Western New England rivers.—During March 26 flood stages were reached in the rivers of Vermont at Barre, Montpelier, Whiteriver Junction, Rutland, and Middleburg, overflowing the lowlands at these places. Rain continued up to the morning of March 27, at which time the 48-hour rainfall at Northfield was 2.69 inches. On the 28th the rivers of Vermont began to subside in their upper reaches, but continued in flood lower down during the 28th and 29th. Railroad traffic was generally interfered with throughout the State from the 25th to the 30th. (Report, W. A. Shaw.)

The floods above described pouring into the Connecticut soon caused a flood in that river reputed to have been the greatest since 1869. The lowlands and towns along the river were more or less flooded, and traffic was generally interfered with. The highest stages reached along the river were as follows:

	Height.	Highest previous.	Year.
	Feet.	*Feet.*	
Whiteriver Junction, Vt.[1]	30.0	22.6	1909
Bellows Falls, Vt.[1]	19.0	19.4	1895
Holyoke, Mass.[1]	12.0	12.7	1869
Springfield, Mass.[1]	20.8	20.8	1896
Hartford, Conn.[1]	26.3	29.8	1854

[1] Report, W. W. Neifert, Hartford.

The rivers of Pennsylvania.—Moderately heavy rains fell in Pennsylvania on March 25, 26, and 27, producing flood stages in the North Branch of the Susquehanna as follows:

	Height.	Flood stage.
	Feet.	*Feet.*
Towanda, Pa	20.0	16
Wilkes-Barre, Pa	28.5	20
Selinsgrove, Pa	17.0	17
Harrisburg, Pa	19.5	17

No serious damage appears to have been done in eastern Pennsylvania. (Report, E. R. Demain, Harrisburg.)

The James River of Virginia reached flood stage on the 27–28th at points between Buchanan and Clifton Forge, Va., as a result of heavy rains over the headwaters on March 26–27. The flood advanced to Lynchburg with a maximum stage of 24.6 feet, advancing more slowly thereafter it reached Richmond, Va., on March 30, with a stage of 17.5 feet. Considerable damage was done at Lynchburg, but the amount there and elsewhere was minimized by the timely warnings that were issued. A previous, though much less pronounced flood, occurred on the James on March 14. (Report, E. A. Evans, Richmond.)

Rivers of South Carolina.—The rains of March 14, 15, and 16 caused floods on the Pedee and its tributaries as follows:

	Height.	Flood stage.
	Feet.	*Feet.*
Pedee at Cheraw, S. C.[1]	36.3	27
Pedee at Smiths Mills, S. C.[1]	17.3	14

[1] Report, J. H. Scott, Charleston.

Rivers of Georgia.—A period of almost continuous rainfall set in over Georgia on the afternoon of March 12, and continued until the morning of the 16th. As a result all of the streams reached high stages; the most pronounced floods occurred on the Savannah River, with a stage of 35.1 feet at Augusta, Ga., flood stage, 32 feet. Floods also occurred on the Altamaha and its two main tributaries, the Oconee and the Ocmulgee. Stages were as follows:

	Height.	Flood stage.
Ocmulgee River:[1]	*Feet.*	*Feet.*
Macon, Ga	23.6	18
Hawkinsville, Ga	27.0	25
Abbeville, Ga	19.0	11
Lumber City, Ga	21.1	15
Oconee River:[1]		
Milledgeville, Ga	33.0	25
Dublin, Ga	26.5	30

[1] Report, W. A. Mitchell, Macon, Ga.

Rivers of Michigan.—The Saginaw River at Saginaw, Mich., was in flood on March 24 and again on March 26. The first flood was partially the result of ice gorges, while the latter was due to heavy rains over the lower Peninsula on the 24th. (Report, F. H. Coleman, Saginaw, Mich.)

Rivers of Tennessee.—Both the Tennessee and Cumberland Rivers were in flood, caused by the rain which fell in connection with the storms of March 23–28.

The following crest stages were reached:

	Height.	Date.	Flood stage.
Upper Tennessee:[1]	*Feet.*		*Feet.*
Chattanooga, Tenn	33.3	Mar. 30	33
Bridgeport, Ala	23.7	Mar. 31	24
Guntersville, Ala	31.5	Apr. 1	31
Decatur, Ala	19.4	Apr. 3	21
Cumberland River:			
Nashville, Tenn	44.9	Apr. 2	40

[1] Report, L. M. Pindell, Chattanooga, Tenn.

After sufficient time has elapsed to permit the collection of the necessary statistics it is purposed to issue a more detailed report on the Ohio floods.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.